

UNCLASSIFIED

AD NUMBER

AD904773

LIMITATION CHANGES

TO:

Approved for public release; distribution is unlimited.

FROM:

Distribution authorized to U.S. Gov't. agencies only; Test and Evaluation; APR 1972. Other requests shall be referred to Aeronautical Systems Division, Attn: SDQH, Wright-Patterson AFB, OH 45433. This document contains export-controlled technical data.

AUTHORITY

ASD ltr, 8 Feb 1974

THIS PAGE IS UNCLASSIFIED

AD904773

FTC-TR-71-26

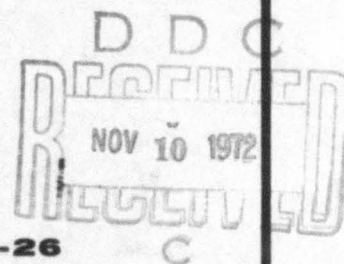
FTC-TR-71-26



**A
F
F
T
C**

**Addendum
CATEGORY II
ICING TEST OF THE
HH-53C HELICOPTER**

CLARK E. LOVRIEN, JR.
Major, USAF
Project Officer and Project Pilot



TECHNICAL REPORT No. 71-26

SEPTEMBER 1972

Distribution limited to U.S. Government agencies only
(Test and Evaluation), April 1972. Other requests for
this document must be referred to ASD (SDQH), Wright-
Patterson AFB, Ohio 45433.

**AIR FORCE FLIGHT TEST CENTER
EDWARDS AIR FORCE BASE, CALIFORNIA
AIR FORCE SYSTEMS COMMAND
UNITED STATES AIR FORCE**

Qualified requesters may obtain copies of this report from the Defense Documentation Center, Cameron Station, Alexandria, Va. Department of Defense contractors must be established for DDC services, or have "need to know" certified by cognizant military agency of their project or contract.

DDC release to OTS is not authorized.

When US Government drawings, specifications, or other data are used for any purpose other than a definitely related government procurement operation, the government thereby incurs no responsibility nor any obligation whatsoever; and the fact that the government may have formulated, furnished, or in any way supplied the said drawings, specifications, or other data is not to be regarded by implication or otherwise, as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.

Do not return this copy. Retain or destroy.

FTC-TR-71-26

Addendum
CATEGORY II
ICING TEST OF THE
HH-53C HELICOPTER

CLARK E. LOVRIEN, JR.
Major, USAF
Project Officer and Project Pilot

Distribution limited to U.S. Government agencies only
(Test and Evaluation), April 1972. Other requests for
this document must be referred to ASD(SDQH), Wright-
Patterson AFB, Ohio 45433.

FOREWORD

The Category II test plan required penetration into moderate natural icing conditions to verify experience in artificial icing. Moderate icing conditions were not encountered during the Category II test program and the natural icing was limited to five flights in trace to light icing conditions. A subsequent unplanned flight through natural light/moderate icing occurred and is reported in this addendum to FTC-TR-71-26, June 1971.

Foreign announcement and dissemination by the Defense Documentation Center are not authorized because of technology restrictions of the U.S. Export Control Acts as implemented by AFR 400-10.

Prepared by:



CLARK E. LOVRIEN, JR.
Major, USAF
Project Officer and Project Pilot

Reviewed and approved by:

12 September 1972



JAMES W. WOOD
Colonel, USAF
Commander, 6510 Test Wing



ROBERT M. WHITE
Brigadier General, USAF
Commander

TEST AND EVALUATION

Natural icing was encountered by the icing test helicopter, USAF S/N 68-10354, while on a ferry flight manned by the same crew that conducted formal icing tests. Light/moderate rime icing was encountered while flying at 9,000 feet MSL on the low altitude airway between El Paso and Fort Stockton, Texas. Flight conditions were 115 knots indicated airspeed (KIAS), minus 10 degrees C, 9,000 feet MSL, 65-percent torque on both engines at approximately 105-percent rotor speed, approximately 50 percent indicated on the cruise guide, and a gross weight of approximately 40,000 pounds. Flight was entirely in the clouds. Rime ice accumulated at the rate of approximately 1/4 inch per 10 minutes. When a noticeable accumulation was evident on the engine air particle separator (EAPS) inlets, the EAPS doors were closed.

When almost 3/4-inch of ice had been accumulated, the indicated airspeed began falling off and the power requirement increased. The pilot asked Air Traffic Control for descent to 7,000 feet MSL, but was unable to descend for approximately 20 minutes. The worst conditions existed just before descent when a full inch of ice had accumulated on the windshield wiper arms (the recommended area for observation of ice accretion rate). Approximately 80-percent torque was required to maintain level flight at 90 KIAS. When a descent was made to 7,000 feet MSL the airspeed increased to 115 KIAS again, and the power requirement decreased to the normal 65 percent for that speed. All of the ice was still intact on fuselage areas visible from the cockpit. Some ice was shed from the main rotor blades. This was made evident by seeing and hearing ice strike the fuselage and windshield. A few pieces of ice were also seen departing to the front quadrants. While at 7,000 feet MSL an additional 1/8-inch clear ice accumulated on top of the rime ice.

The special instrumentation installed in the helicopter for the tests was operating on this flight. With EAPS doors open, the EAPS differential pressure was +5.7 inches of water. When the EAPS doors were closed, the EAPS differential pressure decreased to -7.2 inches of water. As ice accumulated adjacent to the EAPS strata tube inlets, the pressure decreased to as low as -8.2 inches of water. The ice eventually shed from the area adjacent to the strata tube inlets, and the differential pressure increased to or near the original pressure (from -7.6 to -7.2 inches of water). The cycle was repeated as the ice again built up on the EAPS. This duplicated the process that occurred during the artificial icing tests in Alaska. Apparently the artificial icing trials were at least as severe as natural icing under the same conditions. The medium frequency vertical vibrations or lateral shuffle associated with ice shedding from the tail and main blades, respectively, that occurred in the artificial icing trails, did not occur in natural conditions.

The pitot heat and windshield anti-ice were completely effective (as they were during the artificial icing tests also). The engine anti-ice was not turned on, so bleed air was not heating the inlet guide vanes. It is believed that there was no significant icing of the inlet guide vanes because no abnormal engine parameters were noted. The EAPS were not opened again until all ice had sublimated or melted from the inlets. The aircraft was exposed to icing conditions for approximately 50 minutes.

This icing encounter correlated with the results observed and reported during the artificial icing trials. The H-53 performed very well in light/moderate natural icing. The present clearance for operation in moderate icing is valid.

UNCLASSIFIED

Security Classification

DOCUMENT CONTROL DATA - R & D		
<i>(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)</i>		
1. ORIGINATING ACTIVITY (Corporate author)		2a. REPORT SECURITY CLASSIFICATION
Air Force Flight Test Center Edwards AFB, California		UNCLASSIFIED
		2b. GROUP
		N/A
3. REPORT TITLE		
Category II Icing Test of the HH-53C Helicopter (Addendum)		
4. DESCRIPTIVE NOTES (Type of report and inclusive dates)		
Final		
5. AUTHOR(S) (First name, middle initial, last name)		
Clark E. Lovrien, Jr., Major, USAF		
6. REPORT DATE	7a. TOTAL NO. OF PAGES	7b. NO. OF REFS
September 1972	2	N/A
8a. CONTRACT OR GRANT NO.	9a. ORIGINATOR'S REPORT NUMBER(S)	
b. PROJECT NO.	FTC-TR-71-26	
c. AFFTC Project Directive 71-24	9b. OTHER REPORT NO(S) (Any other numbers that may be assigned this report)	
d.	N/A	
10. DISTRIBUTION STATEMENT Distribution limited to U.S. Government agencies only (test and evaluation), April 1972. Other requests for this document must be referred to ASD (SDQH), Wright-Patterson AFB, Ohio 45433.		
11. SUPPLEMENTARY NOTES		12. SPONSORING MILITARY ACTIVITY
Addendum to basic report (June 1971).		6510 Test Wing Edwards AFB, California
13. ABSTRACT		
<p>The Category II test plan required penetration into moderate natural icing conditions to verify experience in artificial icing. Moderate icing conditions were not encountered during the Category II test program and the natural icing was limited to five flights in trace to light icing conditions. A subsequent unplanned flight through natural light/moderate icing occurred and is reported in this addendum to FTC-TR-71-26, June 1971.</p>		

UNCLASSIFIED
Security Classification

14 KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
HH-53C helicopter icing tests						

UNCLASSIFIED
Security Classification